2-WIRE DIAL PULSE ORIGINATING (DPO9 AND DPO6) CHANNEL UNIT, 628140

GENERAL DESCRIPTION

CONTENTS PAGE

1. GENERAL 1
2. DESCRIPTION 1
3. FUNCTIONAL OPERATION (FIG. 2) 2
HYBRID 2
TRANSMIT VF CIRCUIT 2
RECEIVE VF CIRCUIT 2
TRANSMIT SIGNALING 2
RECEIVE SIGNALING 2
CARRIER GROUP ALARM 4
BUSY MODE 4
4. OPTIONS 4
5. RESTRICTIONS 4
6. TEST AND MAINTENANCE FEATURES 4
7. TECHNICAL SUMMARY 4
8. REPLACEABLE PARTS 6
9. REFERENCES 6

1. GENERAL

1.01 This Section provides a general description of the ITT D448 2-wire dial pulse originating (DPO9 and DPO6) channel unit, 628140 (Fig. 1), to the functional block diagram level.

1.02 This Section has been reissued to include information on the handling of CMOS-equipped units.

1.03 The unit provides a voice frequency (VF) and signaling interface between the central office (C.O.) equipment and the D448 multiplex terminal common equipment. In the transmit direction, the unit converts VF and signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the unit decodes received PCM into VF and signaling information. During system outages, the unit provides various disconnect/make-busy routines for the trunk. The unit provides the originating end of a 900- or 600-ohm, 2-wire reverse battery loop signaling message circuit.

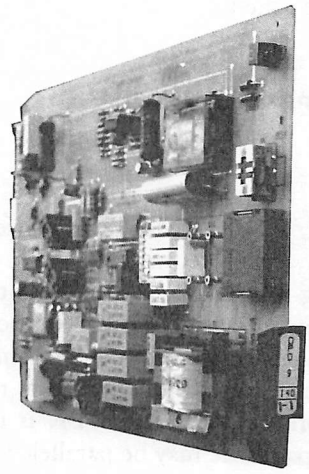


Fig. 1—DPO Channel Unit, 628140

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-440.

2.02 The unit is available in two groups. Group -0 provides 900-ohm plus 2.16-uF impedance matching. Group -1 provides 600-ohm plus 2.16-uF impedance matching. Group -0 is designated by the mnemonic DPO9. Group -1 is designated by the mnemonic DPO6.

2.03 The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (DPO9 or DPO6), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The LC LED (DS1), the BSY switch (S5), and the splitting card jack (J1) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 2)

HYBRID

3.01 The hybrid is toll-grade and provides 28-dB (minimum) echo return loss and a 20-dB (minimum) singing return loss. Either the internal compromise network (by selecting DIP switch option [CN]) or an external precision balance network (PBN) may be used to balance the hybrid. Regardless of whether the internal compromise network or an external PBN is used, additional build-out capacitance may be paralleled across it by selecting DIP switch options [2] through [64]. Build-out capacitance from 0.002 to 0.126 uF in 0.002-uF steps may be selected. The NT and NR leads are brought out for connection to an external PBN. If an external PBN is used, the [CN] DIP switch should be opened (not selected).

TRANSMIT VF CIRCUIT

3.02 The incoming VF is transformer-coupled to the low-pass/high-pass filter where it is amplified and filtered. The gain applied to the input signal can be varied over a 3-dB range to compensate for VF input levels from 0 to -3.0 dBm (in 1-dB steps) by the selection of transmit (TX) prescription level DIP switch options [-1], [-2], or [-3]. The resulting signal is passed to the TX office wiring loss (OWL) compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal applied to the encoder to compensate for office wiring/cabling losses. The resultant range for input levels is 0 to -4.5 dBm in 0.1-dB steps.

3.03 The encoder converts the VF signal and signaling information (Para. 3.06 through 3.08) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

RECEIVE VF CIRCUIT

3.04 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.09 through 3.12).

3.05 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified. This amplification can be varied over a 6-dB range (in 1-dB increments) by the selection of RX prescription VF level DIP switch options [-1] through [-6]. This provides output levels of $+1.5$ to -6.0 dBm in 0.1-dB increments with both the OWL and prescription VF level options. The amplified VF is transformer-coupled to the C.O. equipment.

TRANSMIT SIGNALING

3.06 An on-hook condition is represented by an open loop at the 2-wire drop. This condition is detected by the TX signaling (SIG) interface circuit, which applies a digital zero to the encoder. However, the encoder will not process the information until it is signaled on the TA/B lead by the TLU that the signaling frame is upcoming.

3.07 An off-hook condition is represented by a closed loop at the 2-wire drop. This condition is detected by the TX SIG interface circuit, which applies a digital one to the encoder. The signal is processed by the encoder as described in Para. 3.06. The LC LED is also turned on.

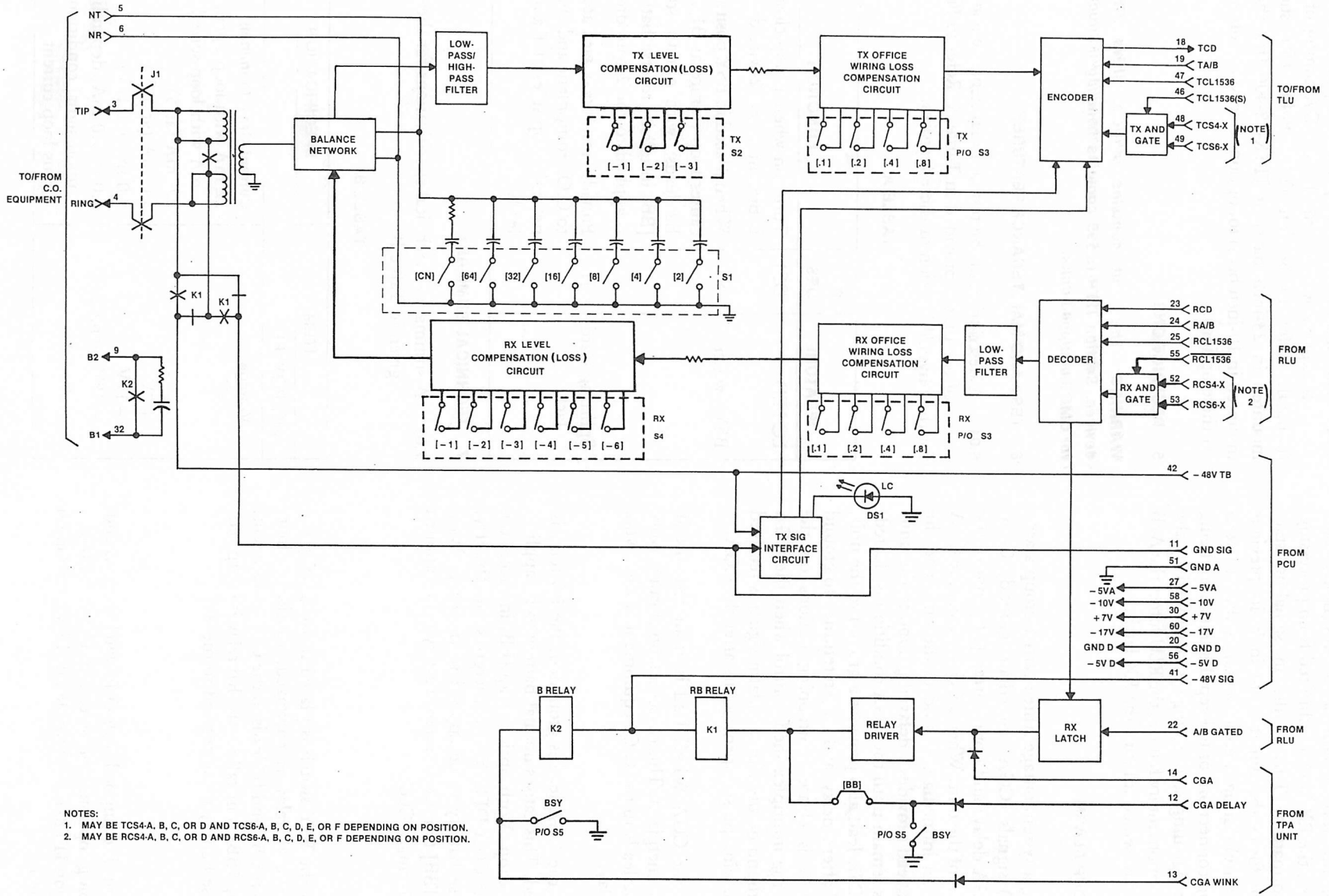
3.08 Dialing is presented by the C.O. equipment as either battery-ground pulsing or loop pulsing applied to the 2-wire drop. The dialing information is applied to the TX SIG interface circuit and processed as described in Para. 3.06.

RECEIVE SIGNALING

3.09 The decoder converts receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to the RX latch.

3.10 During an idle condition, the RB relay is deenergized. This causes normal battery (tip-positive, ring-negative) to be applied to the 2-wire drop.

3.11 During a busy condition, the RB relay is energized. This causes reverse battery (tip-negative, ring-positive) to be applied to the 2-wire drop.



NOTES:
1. MAY BE TCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.
2. MAY BE RCS4-A, B, C, OR D AND RCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.

Fig. 2—DPO Channel Unit, 628140, Functional Block Diagram

3.12 During intermittent terminal failures (momentary failures), the RX latch is inhibited from processing signaling information. This results in signaling state storage, which forces the unit to remain in its previous state (idle or busy) during the momentary failure to keep from dropping connections or to keep the unit from being accessed. The signaling state storage is controlled by the RLU. During a momentary failure, the RLU forces the A/B GATED lead low which inhibits the RX latch.

CARRIER GROUP ALARM

3.13 During a system outage, three carrier group alarm (CGA) signals (CGA immediate ground, CGA wink, and CGA delay) and option strap [BB] control the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit, and the CGA DELAY lead provides a delayed ground to the unit. Both grounds remain until the CGA condition is cleared. The CGA WINK lead also provides a ground to the unit, but is opened after a delay, and is then returned to ground until the CGA is cleared. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received and when the wink pulse (open) occurs after the CGA.

3.14 When the CGA WINK lead is grounded, the B relay is energized. This causes a loop closure across the B1 and B2 leads to the C.O. equipment, with a wink off after a delay.

3.15 When the CGA lead is grounded, the RB relay is released. This causes normal battery to be applied to the 2-wire drop. With option strap [BB] in place, the ground on the CGA DELAY lead energizes the RB relay, causing reverse battery to be applied to the drop. With option strap [BB] removed, reverse battery is not applied to the drop during a CGA.

BUSY MODE

3.16 When the BSY switch is placed in the BSY position, the B relay is energized, causing a loop closure across the B1 and B2 leads to the C.O. equipment. If option strap [BB] is installed, the RB relay is energized, causing reverse battery to be applied to the drop.

4. OPTIONS

4.01 The unit is equipped with DIP switch options and strapping options for selecting circuit options. Refer to Section ITTR-18-440 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
LC LED	DS1	Turns on when a loop closure is present at the 2-wire drop.
BSY Switch	S5	When placed in BSY position, causes loop closure at B1 and B2 leads; with option strap [BB] installed, reverse battery is applied to the 2-wire drop.
Splitting Card Jack	J1	Provides test/break jack access to C.O. equipment and channel unit drop sides of T and R leads.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage	**Current Drain (nominal)**
– 5V	22 mA with loop open; 29 mA with loop seized
– 10V	2.0 mA (at 5V)
+ 7V	5.0 mA (at 12V)
– 17V	8.0 mA (at 12V)
– 48V Signaling Battery	2.0 to 9.0 mA, depending upon signal conditions plus loop current

TABLE B (CONT)

ITEM	SPECIFICATION
VF PERFORMANCE	
Impedance	
DPO9 (628140-0)	900 ohms plus 2.16 uF
DPO6 (628140-1)	600 ohms plus 2.16 uF
Levels	
Transmit	0 to −4.5 dBm, adjustable in 0.1-dB steps
Receive	+1.5 to −6.0 dBm, adjustable in 0.1-dB steps
Loss Stability (End-to-End)	±0.5 dB over life in 95% of the circuits
Tracking (End-to-End)	
−37 to +3 dBm0 Input	0.5 dB maximum deviation
−50 to −37 dBm0 Input	1.0 dB maximum deviation
Idle Channel Noise (End-to-End)	23 dBrnc0 maximum
Signal-to-Distortion	
0 to −30 dBm0 Input	33 dB minimum overall; 35 dB minimum receive or transmit
−40 dBm0 Input	27 dB minimum overall; 29 dB minimum receive or transmit
−45 dBm0 Input	22 dB minimum overall; 25 dB minimum receive or transmit
Single Frequency Distortion (at 0 dBm0)	
Input Swept from 0 to 12 kHz	−28 dBm0 maximum at any other frequency
Input between 1004 and 1020 Hz	−40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better
Transhybrid Loss	
200 to 500 Hz	20 dB
500 to 1000 Hz	30 dB for DPO9, 28 dB for DPO6
1000 to 2500 Hz	35 dB for DPO9, 30 dB for DPO6
2500 to 3400 Hz	30 dB for DPO9, 28 dB for DPO6

TABLE B (CONT)

ITEM	SPECIFICATION
Echo Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	28 dB minimum
Singing Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	20 dB minimum for DPO9, 19 dB minimum for DPO6
Frequency Response (DPO9) (Referenced to 1020 Hz, End-to-End)	
60 Hz	20.0 dB minimum loss
200 Hz	0 to −5.0 dB
300 to 3000 Hz	+0.5 to −1.0 dB
3200 Hz	+0.4 to −1.5 dB
3400 Hz	0 to −3.0 dB
Frequency Response (DPO6) (Referenced to 1000 Hz at 0 dBm0, End-to-End)	
600 to 2400 Hz	±1.0 dB
300 to 3200 Hz	+1.0 to −3.0 dB
3400 Hz	0 to −3.0 dB
Balance Network	Compromise network of 900 or 600 ohms + 2.16 uF built-in and with BOC in 0.002-uF steps to 0.126 uF (NT and NR brought out for connection to external precision balance network)
Delay Distortion (End-to-End)	94 PAR (minimum)
Longitudinal Balance (AT&T Method)	
200 Hz	66 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum

TABLE B (CONT)

ITEM	SPECIFICATION
Longitudinal Balance (IEEE Method)	
200 Hz	60 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
SIGNALING	
Pulsing Distortion	
Input (at DPO)	150/150-ohm battery-ground pulsing at 12 pps, 73% break over 600-ohm VF extension to the channel unit
Output (at DPT)	71% break maximum
Input (at DPO)	150/150-ohm battery-ground pulsing at 12 pps, 49% break over 0-ohm loop
Output (at DPT)	37% break minimum
Input (at DPO)	Loop pulsing at 12 pps, 68% break, with 2 uF and 600 ohms across pulsing contact, over 600-ohm VF extension to the channel unit
Output (at DPT)	66% break maximum
Input (at DPO)	Loop pulsing at 12 pps, 58% break, with 2 uF and 600 ohms across pulsing contact, with no VF extension to the channel unit
Output (at DPT)	44% break minimum
OPERATING ENVIRONMENT	
Temperature	0 to +55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Width	0.8 in. (1.9 cm)
Height	5.9 in. (15.0 cm)
Depth	9.7 in. (24.6 cm)
WEIGHT	1.1 lb (0.5 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly	628140-000
Schematic	628140-002

9.02 Related information on the unit may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Trunk Channel Units — Option Selection and Installation	ITTR-18-440